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Effect of Starvation and Refeeding on Protein level Muscle, Liver, Kidney, and Gills of freshwater fish *Channa punctatus*

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ABSTRACT

The present study examined starvation and refeed for protein content in different tissues of freshwater fish, *Channa panctatus* by using Lowry's Method (1951). Fish were divided into 2 groups. The first group was fed with normal food and the second is deprived for the period of 7, 14, 21 and 28 days and then the previous one are refeed. Due to prolonged starvation, there is a progressive reduction in protein level in tissues and after refeed the fish show a high increase in protein level as compared with normal.

Keywords: starvation, refeed, *Channa panctatus*

1. INTRODUCTION

Under typical conditions various fish species persist extensive stretches of starvation related for the most part with occasional changes in food accessibility, producing movements, readiness for bringing forth or occasional changes in water temperature. Starvation is typically the aftereffect of helpless farming and, in numerous cases, is a screech to ecological issues. An ineffectively planned or kept up framework is probably going to foster water quality issues with related bleakness or mortality among the fish. With an end goal to address the water quality issues aquarists may scale back feed to where the creatures (fishes) are in a negative caloric equilibrium and being to get in shape, if the issue gets persistent, starvation can result. Starvation is knowledgeable about most types of fish during specific times of consistently to a great extent because of natural conditions and it influences various organs in an unexpected way.

Starvation is a natural part of the life cycle of many aquatic creatures [1]. Due to interest in the compensatory growth phenomena, there is growing evidence on biological responses subsequent food deprivation and re-feeding in fish species. As Proteins have high nutritional value, so get metabolized transferred to storing depots and converted to energy. Starvation also affects the physiology and other constituents of fish [2,3]. Prolonged starvation effects

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on red and white muscles of two freshwater fishes have been studied [4] the study of biochemical and haematological response to starvation in *H.fossilis* [5] they reported the decline in the activity of enzyme lactate dehydrogenase in both liver and muscles as a function of starvation. The amount of protein and glycogen also decreased as the period of starvation increased. In spite of some studies in teleost fishes regarding food deprivation effects on physiological functions, there is still much to be understood about the physiology of sturgeons species. The aim of the present study is to assess the metabolic approaches of *Channa Panctatus* exposed to different periods of starvation and followed by re-feeding. In this study, the effect of starvation and re-feeding was monitored on some biochemical parameters. Knowledge of how fish respond to starvation stages in this study could provide a basis for improved nourishment.

The paper is organized as follows. Section II describes the methodology adopted for the research work. Section III represents the results of effect of starvation and after refeed on muscle, liver, kidney and gills in the form of a, b, c and d section. Section IV and Section V reflects the discussion and conclusion part of the research work respectively.

2. MATERIALS AND METHODS

a) Sampling site

The fish, *Channa panctatus* (Dhok) for present study were netted from Pedhi River Amravati. The area is located about 8-12 km's from Amravati city with GPS location of 21°08'41'N and 77°36'08'E, Maharashtra, India.

b) Biochemical analysis

After acclimatization, healthy specimens of *Channa panctatus* (size ranging between 10-15cm) were divided into control and fasting group in triplicates. Each group contained ten individuals. Control groups were fed with commercially available pellet fish feed twice a day whereas the starved groups were deprived of food for an experimental period of 7, 14, 21 and 28 days. After 28 days the starved fish were again fed with boiled eggs and artificial food. The fishes were sacrificed by blow on their head or by anesthetizing and the muscle, liver, gill and kidney tissue was taken for investigation. The assessment of protein content of tissues of control and experimental fishes was done by using Lowry's method [6].

3. RESULTS

The calculated values for total proteins in various tissues of control and experimental group (starved and refeeded group) along with standard deviation are given in Table 1 and Table 2 graphically represented in fig. 1 and fig 2.

In control fish the total protein content was in the order of Muscle > Liver> Gills > Kidney. In present study it is observed that the protein content in muscle, liver, gills, and kidney of fish were significantly decreased at different Starvation period. After refeeding the fish the again shows the positive deviation which means that fish retains protein content in the order of Muscle > Liver> Kidney > Gills.

Table 1: Protein content (100 mg wet wt. of tissue) in different tissue of control fishes and experimental fishes (Starved)

Tissues	Control	7 Days	14 Days	21 Days	28 Days
Muscle	71.24 ±0.41	65.30 ±0.38	61.56 ± 0.32	55.12± 0.22	49.48± 0.28
Liver	50.57± 0.70	46.32± 0.35	41.48± 0.30	37.18± 0.12	31.7± 0.18
Gills	21.98± 0.47	14.02± 0.09	10.97± 0.08	9.20± 0.20	7.81± 0.22
Kidney	30.56± 0.05	25.17± 0.15	21.36± 0.17	17.01± 0.21	13.38± 0.15

Each value is the mean of 5 individual determinations ± indicates SD.

Table 2: Protein content (100 mg wet wt. of tissue) in different tissue of control fishes and experimental fishes (Refeeded)

Tissues	Control	7 Days	14 Days	21 Days	28 Days
Muscle	71.24 ±0.41	56.48 ±0.30	66.38 ± 0.26	72.54± 0.05	81.64± 0.20
Liver	50.57± 0.70	40.20± 0.11	51.76± 0.30	65.12± 0.25	72.63± 0.10
Gills	21.98± 0.47	13.14± 0.26	25.05± 0.28	37.62± 0.15	52.16± 0.45
Kidney	30.56± 0.05	25.32± 0.35	37.22± 0.12	45.16± 0.10	51.97± 0.05

Each value is the mean of 5 individual determinations ± indicates SD.

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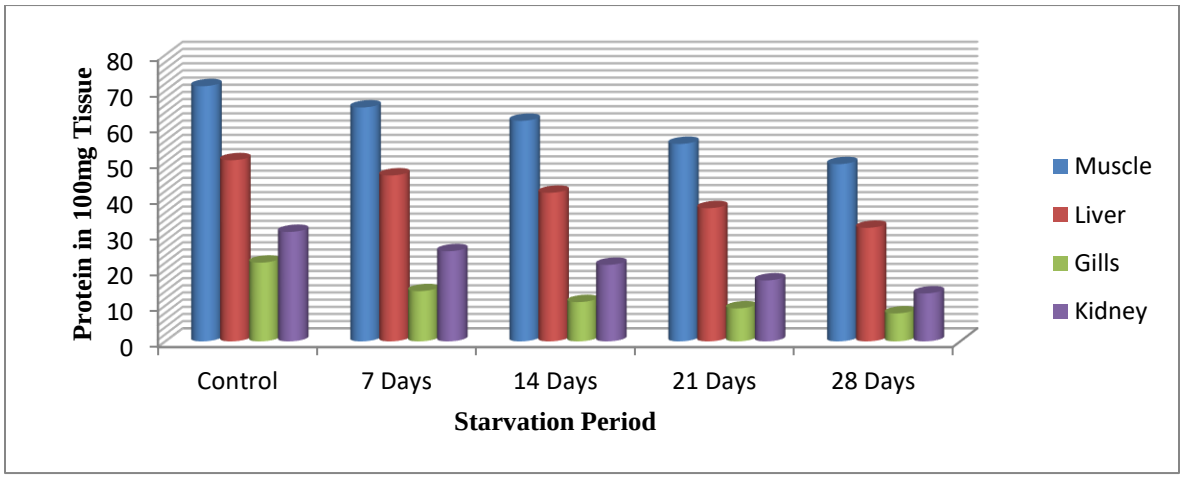

Fig. 1. Protein content (100 mg wet wt. of tissue) in different tissue of control fishes and experimental fishes(Starved).

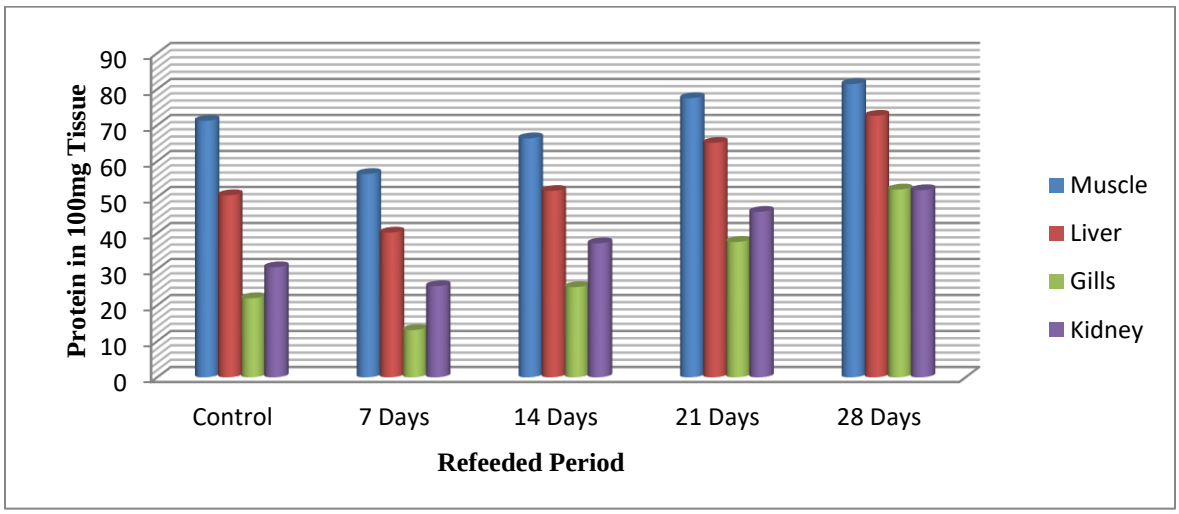

Fig.2 Protein content (100 mg wet wt. of tissue) in different tissue of control fishes and experimental fishes (Refeeded).

The values were originated in the direction of 65.30, 61.56, 55.12 and 49.48 in 100 mg wet wt. of tissue in muscle for 7, 14, 21and 28 days respectively which were linearly declined in contrast with control (71.24) in 100mg wet wt. of tissue. The decreased values were also found in liver which is 46.32, 41.48, 37.18, and 31.7 with respect to the 50.57 in 100 mg wet wt., of tissue for 7, 14, 21 and 28 days correspondingly. The linear decreases were also found in the tissue of gills 14.02, 10.97, 9.20, 7.81 and kidney 25.17, 21.36, 17.01, 13.38 with reverence to normal tissues 21.98 and 30.56 correspondingly (100mg wet wt.) for the period of supposed days. After 28 days the fish were refeeded get weighty and healthy, this sudden change in protein level in all tissue again enhances the metabolic pathways with correlated with normal one.

4. DISCUSSION

The Proteins are, without a doubt, of primary and critical importance not only because of their peculiarities, but also because of their importance in the living world. They appear to provide their biological specialisation to a variety of organisms and various cell types [7]. Proteins are crucial organic compounds that organisms require for tissue construction and play a key function in energy metabolism [8]. Protein is the most important nutrient, a chemical required for the growth and development during times of stress, it also serves as an energy source for the body [9].

Most of the fishes starve during certain period of year, during that period they consume the stored body constituents. Creach and Safaty (1965) reported that the *Clarias batrachus* became weak and less active during the experimental period of starvation. Although many works have published data on the body composition and calorific value (K.cal/g) of the fishes during starvation [10]. The impact of starvation is fingered preferably in active fishes than lethargic one. There he observed interruption of contractile

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proteins more rapidly than connective tissue proteins during starvation [11]. In *Clarias batrachus* reported that extended the period of starvation increases, so long the quantity of protein decreases [12]. Fall in protein concentration after preliminary rise in unlike tissues –liver, gonads, fat body and brain etc., [13]. Starvation in *Channa punctatus* leads to the depletion of protein from skeletal muscle and liver (14). In *Oreochromis rendalli* protein may be increasingly utilized with the progress of starvation [15]. In case of European eel, it consumed muscle proteins at much later stages in starvation [16]. In our study, after 7 days, protein less seem to be utilized, however, the decrease in %age contents of proteins after 28 days compared to 7 days indicate that proteins were rapidly utilized in starvation in *Channa panctatus*. Therefore, the inter connexion of various body ingredients during starvation are very complex which mark it difficult to describe a prime metabolic scheme employed by several species during starvation (17).

Re-feeding after long-term deprivation usually promotes the rapid weight recovery known as compensatory growth. However, alternative reactions can be observed because recovery from starvation depends on various aspects, such as species, ambient conditions, or even the length of the starving period [18, 19, 20]. During re-feeding, the fish exhibited compensatory growth and rapid restoration of their initial metabolic state [21, 22, 20]. This indicates that our results matches with the above research worker the protein level in liver, muscle, kidney and gills increase as the re feeding start in the *Channa punctatus*. This may possibly be due to elevation amount of uptake of nutrients.

5. CONCLUSION

In conclusion, fluctuations in the metabolism of proteins in relation to dissimilar periods of fasting and refeeding were observed as constituting persistence strategies used by *Channa punctatus*. Our results displayed that protein is a significant origin of energy during fasting periods. The metabolic activity of the liver and muscles as one of the principal tissues involved in satisfying energy needs during periods of restricted feeding was also evidenced by this study. After refeeding the levels of protein get increased in huge amount which help in compensatory growth. In addition, there is solid evidence that the *Channa punctatus* species is enormously skilled of replenishing energy assets following different stages of fasting.

Ethical approval

The ANIMALS ethical guidelines for fish, *Channa panctatus* (Dhok) were followed in the study for sample collection & biochemical analysis.

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This study has not received any external funding.

Conflicts of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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